glycosaminoglycan shape and conformation and show clearly how the ordered structures seen in the condensed phase can be extensively modified in solution. The hydrodynamic studies described by Charles Phelps also emphasize the conformational ordering that can occur in solution and, to the question he asks at the beginning of the chapter, "Have we obtained good value for our money in hydrodynamic studies...", I would answer "Yes!". The contributions by Hardingham and by Fransson et al., who would qualify under Phelps' definition of "...those toilers at the mill where centrifuges, viscometers and light scattering photometers abound...", are excellent reviews of the higher levels of organisation that glycosaminoglycans and proteoglycans can achieve through self-association and aggregation.

In short, this is a book that should be in the library of all groups investigating the biochemical and biophysical properties of the extracellular matrix.

M.T. Bayliss

Free Radicals in Biology and Medicine

by Barry Halliwell and John M.C. Gutteridge

Clarendon Press; Oxford, 1985

xii + 346 pages. £30.00

This book will, I believe, be used and appreciated by many readers, including students, chemists, biochemists, biologists and clinicians. In the preface the authors say that the book is aimed mainly at the latter two groups and, for this reason, it assumes virtually no knowledge of chemistry and attempts to lead the reader as painlessly as possible into an understanding of what free radicals are, how they are generated, and how they react. To this end, the first two chapters are concerned with a general introduction to the properties of oxygen and of free radicals and with the chemistry of oxygen radicals and other oxygen-derived species. There is also an appendix at the end of the book that contains further information on atomic structure and bonding.

The other six chapters provide readable accounts of the roles of radical reactions in a number of biological systems, viz. lipid peroxidation in membranes, protection against radical damage in plants and in the eye, free radicals in toxicology (including sections on herbicides, cigarette smoke and ethanol), free radicals as useful species (phagocytosis, prostaglandins and lipoxygenase products) and free radicals in aging and disease (autoimmune disease and cancer).

The authors also offer many incidental pieces of useful advice to readers who are making their first experimental ventures in the free radical field. For example, they caution users of xanthine oxidase as a laboratory source of the superoxide radical of the presence of proteases in commercial preparations of the enzyme. In relation to methods for measuring lipid peroxidation, they comment that whatever method is chosen, one should think clearly about *what* is being measured and *how* it relates to the overall lipid peroxidation process and, whenever possible, two or more different assays methods should be used.

A small criticism is that some confusion may arise from the fact that the superoxide radical is consistently referred to as O_2^- rather than as $O_2^{\cdot-}$. Some readers may also wish that the authors had not chosen to omit all references from the text, particularly as one is not always able to follow up observations and theories that are attributed in the text to individual workers by consulting the quite extensive and otherwise useful lists of original

papers, reviews and books that are provided for further reading at the end of each chapter.

Most welcome features are the tabulated information and the liberal provision of chemical structures (ranging, for example, from antioxidants to antitumour drugs) throughout the volume. It is also refreshing, when books on relatively specialised topics are not infrequently composed of isolated chapters by different contributors that have been assembled with relatively little regard to their interactions and overlap, to be conscious that the authors have worked hard to provide a balanced and catholic coverage. The book can therefore be recommended as a valuable and convenient source of information for the growing numbers of workers who are interested in radical reactions in biological systems and in clinical situations.

J.A. Lucy

The Biochemistry of the Carotenoids: Volume II, Animals

by T.W. Goodwin

Chapman and Hall; London, 1984

224 pages. £25.00

Although carotenoids have proved a source of fascination to a wide range of biologists from early in the century, the methods used did not match the complexity of the structures which they sought to understand. The application of more sophisticated chemical methods over the thirty years since the publication of the first edition of this work has brought about a revolution in our understanding of the range of these pigments found in nature. In this volume Professor Goodwin has gathered together the widely scattered and often rather unrelated pieces of information on animal carotenoids to give us a coherent picture, albeit one with many gaps. In the first chapter he discusses our knowledge of the carotenoproteins of invertebrates before proceeding with chapters reviewing the pigments found in each group of animals from sponges to mammals. The core of the discussion is concerned with the distribution of carotenoids in the range of species which have been investigated and the structures of those pigments. Additionally, there are comments on the source of the pigments and the metabolic transformations which many organisms carry out, for example, the conversion of β-carotene to astaxanthin in Crustacea. The question of pigment function is also briefly reviewed. Professor Goodwin has kept to his brief in restricting discussion to "distribution biogenesis and function of the carotenoids" and in consequence vitamin A, retinal and proteins which bind these compounds are afforded only a mention. The potential clinical uses in man are also omitted.

This book, with over 1500 references, is an essential guide for all scientists with an interest in animal carotenoids. Inevitably, with such a wealth of detail there are a few errors but these are far outweighed by the overall value of the work. It is a pleasure to read and must surely stimulate interest in the field particularly since Professor Goodwin has drawn attention to many areas which need further investigation.

J. Prebble